

Goniophotometry Report

1_PHOT_NINETY-NINE-2000lmChip-2700K-21Deg_2303
www.factorylux.com



Tested Light Source - 1_PHOT_NINETY-NINE-2000lmChip-2700K-21Deg_2303

Laboratory and Equipment

Laboratory Owner and Location
Goniospectrometer System and Type
Spectrometer Manufacturer and Model

Factorylux, Greenhill Mills, Hebden Bridge, HX7 5QF, UK
BaseSpion – Type C, horizontal
Ibsen Photonics, Denmark – Freedom VIS (Custom Viso)

Measurement Conditions

Number of C-planes and Resolution
 γ (gamma)-Resolution
Test Distance
Input Power, Power and Displ. Factors
Input RMS Voltage and Current
Frequency of Input Power

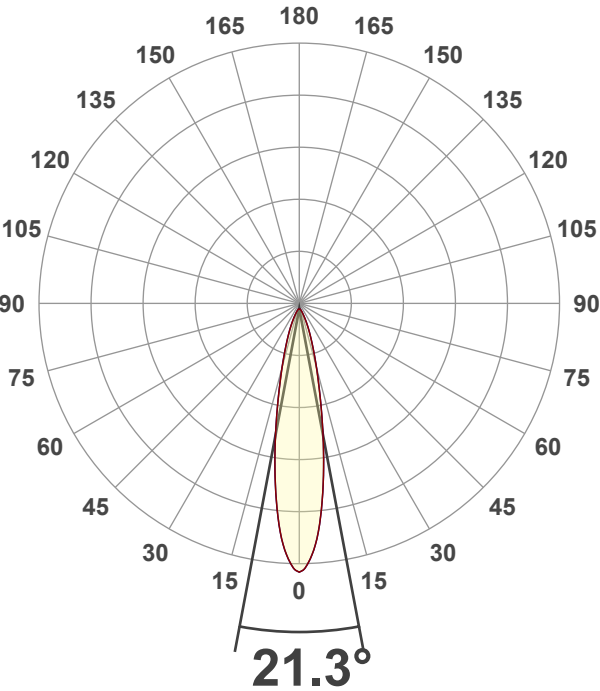
32 planes – 11.25°
1°
1.50 m
15.9 W – PF 0.98 – DPF 0.98
238 V – 0.068 A
50 Hz

Main Light Measurement Results

Output
Efficiency
Peak Intensity and Beam Angle
Color Rendering Index

1497 lm
94 lm/W
6616 cd – 21.3°
CRI 92.9

Light Intensity Distribution



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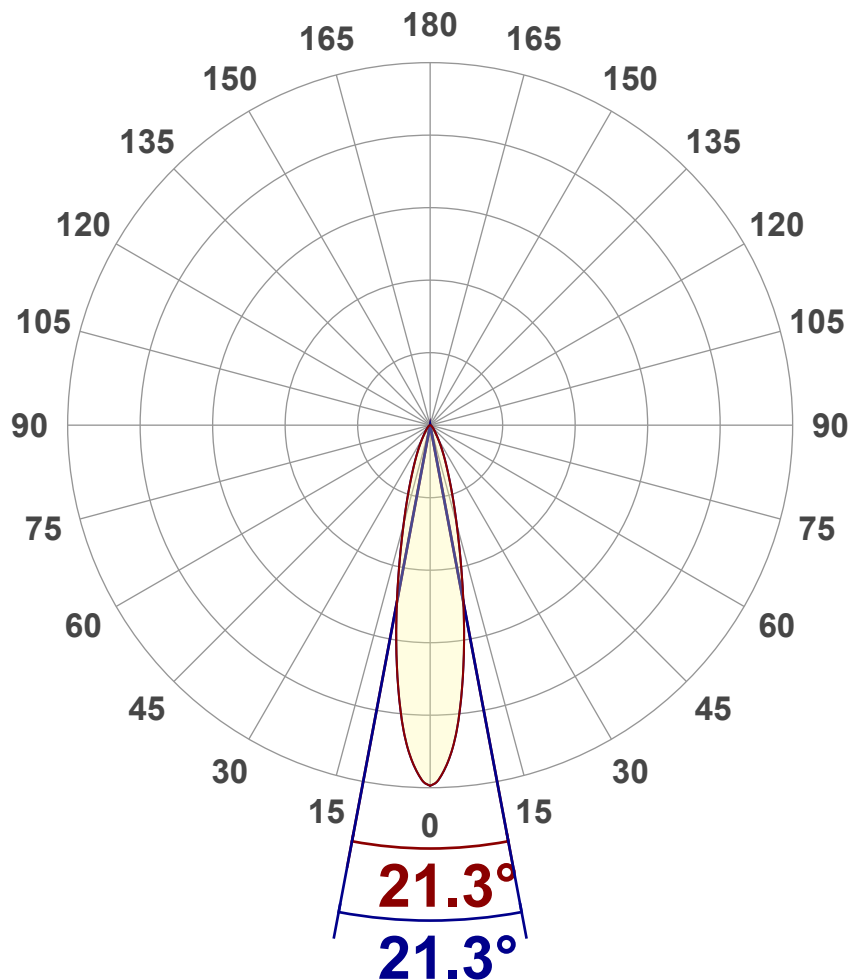
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Luminous Intensity diagram

Unit: 0-100% of peak intensity



Main Values

Output (total Lumen)	1497 lm
Peak Intensity	6616 cd
Beam Angle (50%)	21.3°
Beam Angle (90%)	21.3°
Beam Angle (10%)	21.3°

Cut-off Angle

Average 2,5%	70.8°
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Field Angle

Average 10%	47°
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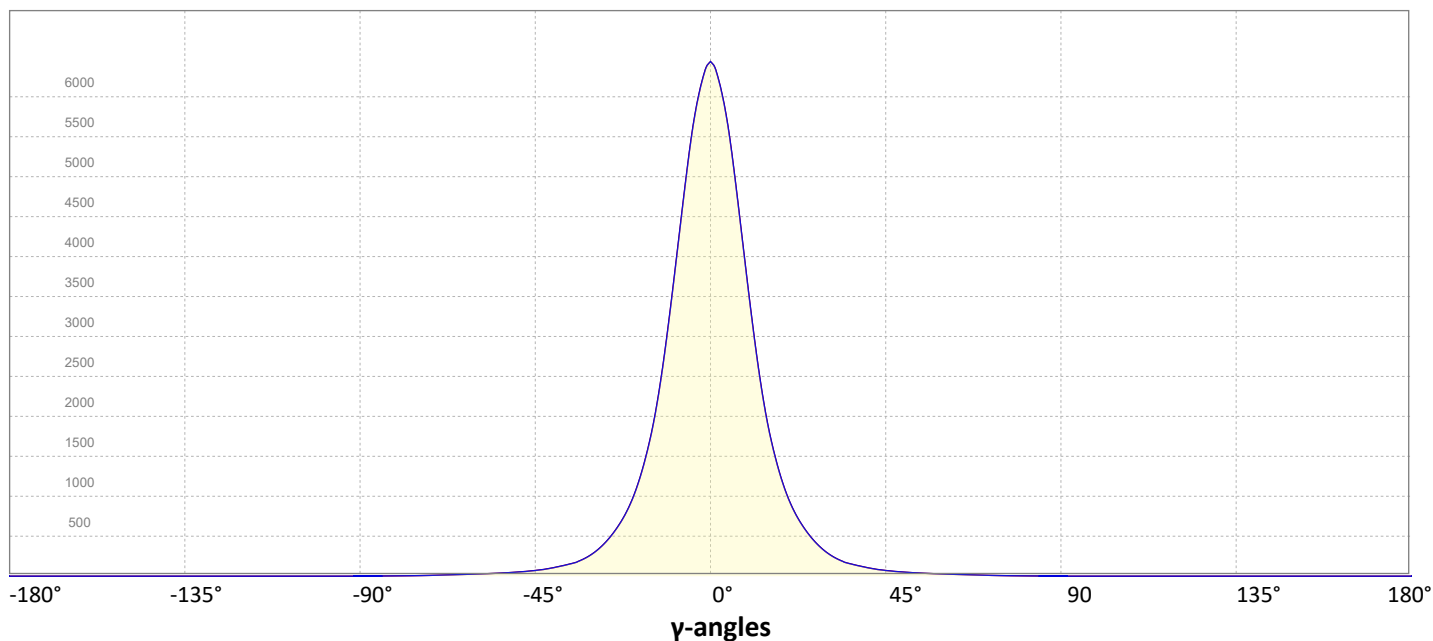
Intensity Ratio

In 120° cone	98.0%
In 90° cone	94.1%

C000-C180

C090-C270

Linear distribution diagram - Intensity (candela) vs γ-angle

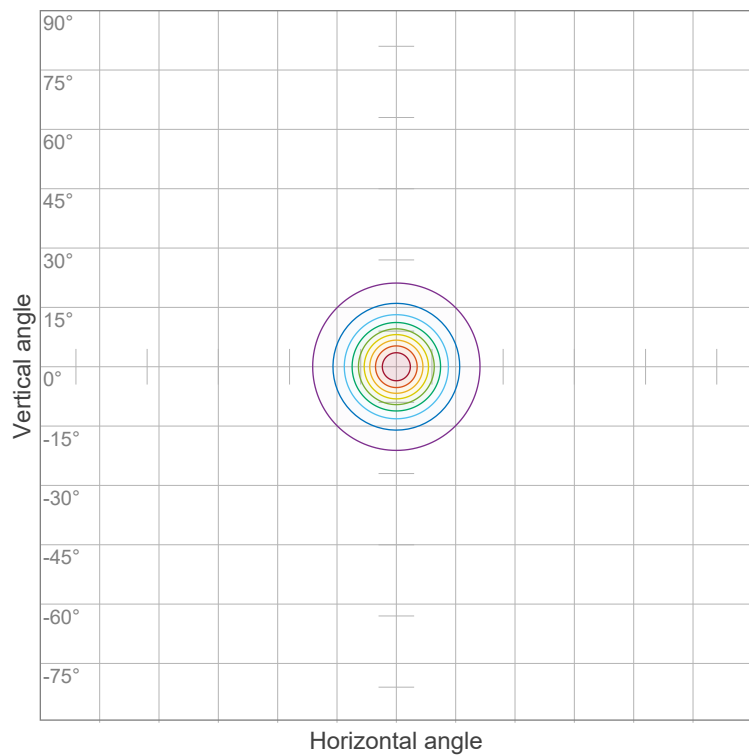


Goniophotometry Report

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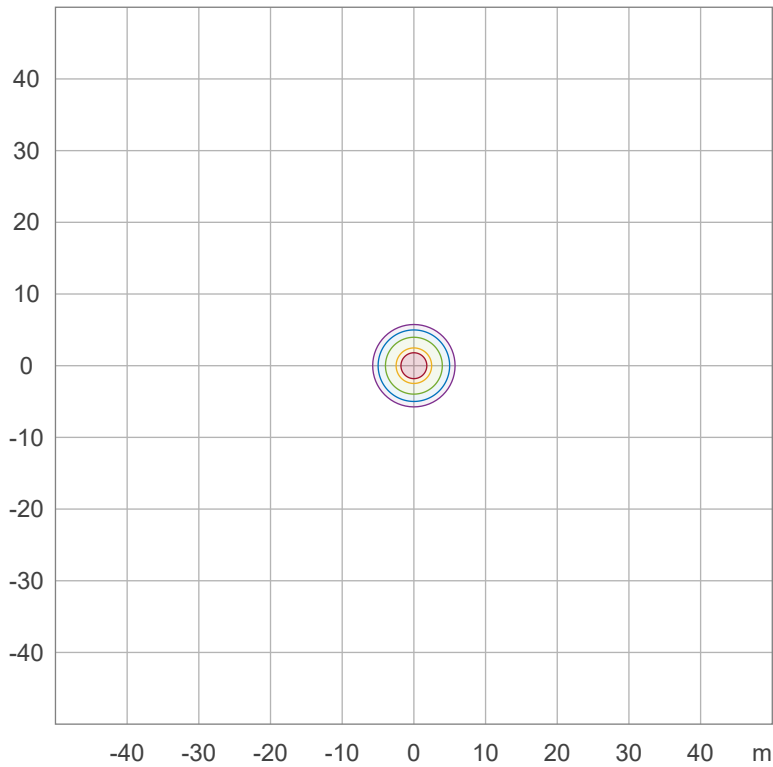
Iso-intensity Diagram (Iso-candela)



90 %	5954.7 cd
80 %	5293.0 cd
70 %	4631.4 cd
60 %	3969.8 cd
50 %	3308.1 cd
40 %	2646.5 cd
30 %	1984.9 cd
20 %	1323.3 cd
10 %	661.6 cd

Peak intensity: 6616.3 cd
Number of c-planes: 32

Iso-illuminance Diagram (Iso-lux)



50.0 %	33.1 lx
30.0 %	19.8 lx
10.0 %	6.6 lx
5.0 %	3.3 lx
3.0 %	2.0 lx

Peak illuminance: 66.2 lx
Mounting height: 10.0 m
Number of c-planes: 32

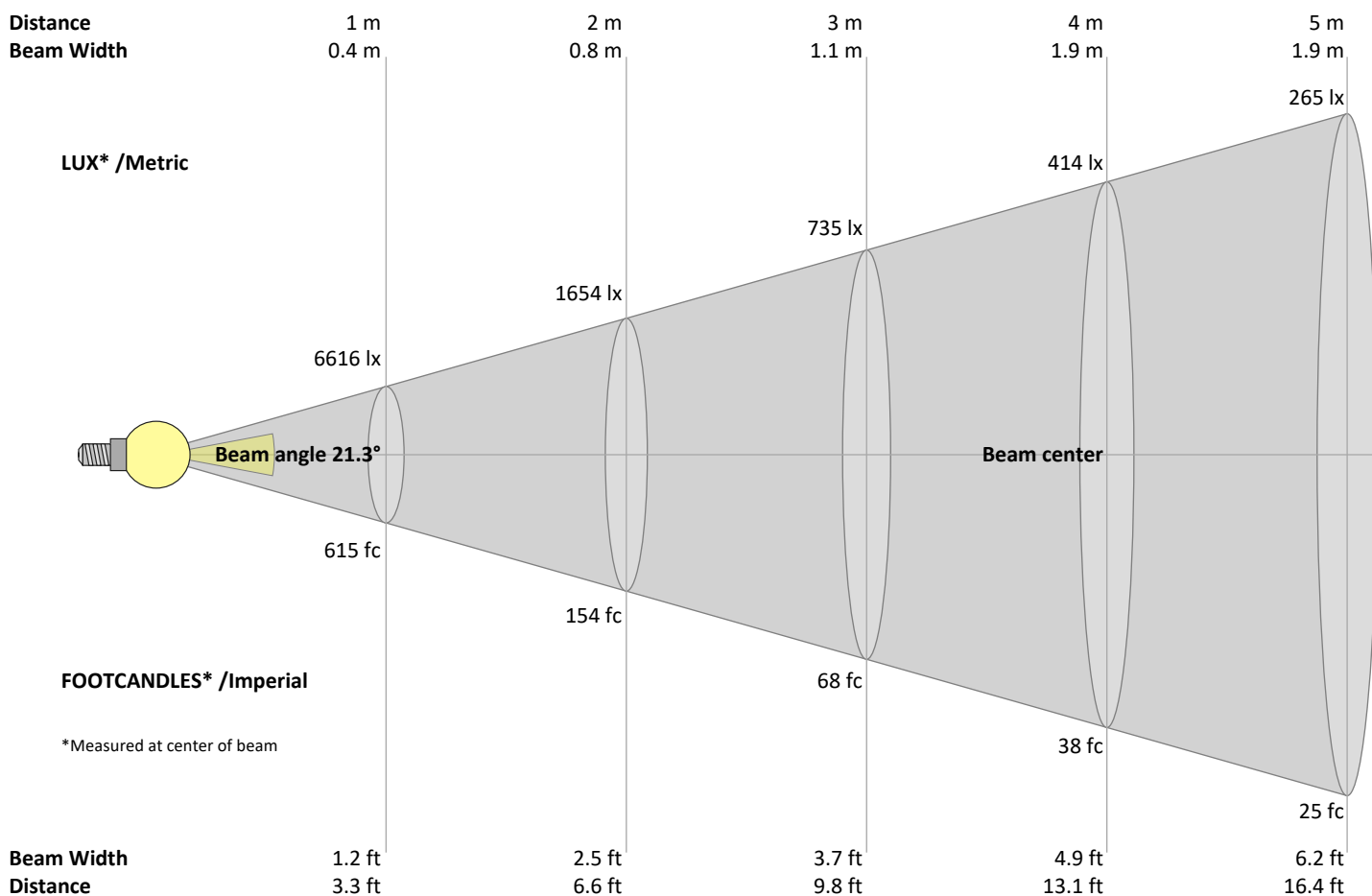
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Beam Details



Beam intensities from 1 – 20 m

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	m
3.3	6.6	9.8	13.1	16.4	19.7	23	26.2	29.5	32.8	36.1	39.4	42.7	45.9	49.2	52.5	55.8	59.1	62.3	65.6	ft
6616	1654	735	414	265	184	135	103	82	66	55	46	39	34	29	26	23	20	18	17	lux
614.7	153.7	68.3	38.4	24.6	17.1	12.5	9.6	7.6	6.1	5.1	4.3	3.6	3.1	2.7	2.4	2.1	1.9	1.7	1.5	fc

Intensities in 0° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
6616	6402	5938	5236	4406	3565	2791	2147	1661	1288	1001	787	623	490	383	300	236	189	159	135	cd
100%	97%	90%	79%	67%	54%	42%	32%	25%	19%	15%	12%	9%	7%	6%	5%	4%	3%	2%	2%	of 0°val

Intensities in 90° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
6616	6402	5938	5236	4406	3565	2791	2147	1661	1288	1001	787	623	490	383	300	236	189	159	135	cd
100%	97%	90%	79%	67%	54%	42%	32%	25%	19%	15%	12%	9%	7%	6%	5%	4%	3%	2%	2%	of 0°val

Intensities in 180° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
6616	6402	5938	5236	4406	3565	2791	2147	1661	1288	1001	787	623	490	383	300	236	189	159	135	cd
100%	97%	90%	79%	67%	54%	42%	32%	25%	19%	15%	12%	9%	7%	6%	5%	4%	3%	2%	2%	of 0°val

Intensities in 270° c-plane

0°	2°	4°	6°	8°	10°	12°	14°	16°	18°	20°	22°	24°	26°	28°	30°	32°	34°	36°	38°	γ
6616	6402	5938	5236	4406	3565	2791	2147	1661	1288	1001	787	623	490	383	300	236	189	159	135	cd
100%	97%	90%	79%	67%	54%	42%	32%	25%	19%	15%	12%	9%	7%	6%	5%	4%	3%	2%	2%	of 0°val

Goniophotometry Report

1_PHOT_NINETY-NINE-2000lmChip-2700K-21Deg_2303
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Light Planning – UGR table

Uncorrected, comprehensive UGR table according to 117-1995

Reflectances											
	p Ceiling	70	70	50	50	30	70	70	50	50	30
	p Walls	50	30	50	30	30	50	30	50	30	30
	p Floor	20	20	20	20	20	20	20	20	20	20
Room size		Viewed Crosswise					Viewed Endwise				
H = mounting height above eye level		(Viewing direction orthogonal to lamp length axis)					(Viewing direction parallel to lamp length axis)				
X	Y										
2H	2H	17.4	17.9	17.5	18.1	18.3	17.4	17.9	17.5	18.1	18.3
	3H	17.7	18.4	18.1	18.6	18.7	17.7	18.4	18.1	18.6	18.7
	4H	17.8	18.5	18.2	18.7	18.9	17.8	18.5	18.2	18.7	18.9
	6H	18.0	18.5	18.3	18.8	19.1	18.0	18.5	18.3	18.8	19.1
	8H	18.0	18.5	18.3	18.8	19.2	18.0	18.5	18.3	18.8	19.2
	12H	18.0	18.5	18.3	18.8	19.2	18.0	18.5	18.3	18.8	19.2
4H	2H	17.5	18.1	17.8	18.3	18.5	17.5	18.1	17.8	18.3	18.5
	3H	18.1	18.6	18.4	18.9	19.4	18.1	18.6	18.4	18.9	19.4
	4H	18.2	18.7	18.6	19.1	19.6	18.2	18.7	18.6	19.1	19.6
	6H	18.3	18.8	18.8	19.2	19.5	18.3	18.8	18.8	19.2	19.5
	8H	18.3	18.8	18.9	19.2	19.5	18.3	18.8	18.9	19.2	19.5
	12H	18.4	18.7	18.9	19.1	19.6	18.4	18.7	18.9	19.1	19.6
8H	4H	18.2	18.7	18.7	19.0	19.4	18.2	18.7	18.7	19.0	19.4
	6H	18.4	18.7	18.9	19.2	19.7	18.4	18.7	18.9	19.2	19.7
	8H	18.5	18.8	19.0	19.3	19.9	18.5	18.8	19.0	19.3	19.9
	12H	18.6	18.8	19.2	19.3	19.9	18.6	18.8	19.2	19.3	19.9
12H	4H	18.2	18.5	18.7	18.9	19.4	18.2	18.5	18.7	18.9	19.4
	6H	18.4	18.7	19.0	19.2	19.8	18.4	18.7	19.0	19.2	19.8
	8H	18.5	18.7	19.1	19.2	19.8	18.5	18.7	19.1	19.2	19.8

Variations with the observer position for the luminaire spacings, S:

S = 1.0H	1.4 / -1.0	1.4 / -1.0
S = 1.5H	2.9 / -1.6	2.9 / -1.6
S = 2.0H	4.4 / -2.3	4.4 / -2.3

Coefficients of Utilization

Ceiling reflectance	80			70			50			30			10			0		
Wall reflectance	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0
Floor reflectance	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0
RCR		(RCR: Room Cavity Ratio)			Room Values are expressed as percentage of Lumen delivered to the task surface													
0	119	119	119	119	116	116	116	116	111	111	111	106	106	106	102	102	102	100
1	114	112	110	108	112	110	108	106	106	104	103	102	101	100	99	98	97	95
2	110	105	102	99	108	104	101	98	101	98	96	98	96	94	95	93	92	90
3	105	100	96	92	103	99	95	92	96	93	90	94	91	89	92	89	87	86
4	101	95	90	87	100	94	90	86	92	88	85	90	87	84	88	86	84	82
5	98	91	86	82	96	90	85	82	88	84	81	87	83	81	85	82	80	79
6	94	87	82	79	93	86	82	78	85	81	78	84	80	77	82	79	77	76
7	91	84	79	75	90	83	78	75	82	78	75	81	77	74	80	76	74	73
8	88	81	76	72	87	80	75	72	79	75	72	78	74	72	77	74	71	70
9	85	78	73	70	84	77	73	70	76	72	70	76	72	69	75	72	69	68
10	83	75	71	68	82	75	70	67	74	70	67	73	70	67	73	69	67	66

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[illegible]

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Outdoor Light Planning

Lumen per Zone

Zone (γ)	Lumen	% Total
0-10°	467 lm	31.2%
10-20°	535 lm	35.7%
20-30°	260 lm	17.4%
30-40°	113 lm	7.6%
40-50°	59 lm	3.9%
50-60°	34 lm	2.3%
60-70°	19 lm	1.3%
70-80°	8 lm	0.5%
80-90°	2 lm	0.2%
90-100°	0 lm	0.0%
100-110°	0 lm	0.0%
110-120°	0 lm	0.0%
120-130°	0 lm	0.0%
130-140°	0 lm	0.0%
140-150°	0 lm	0.0%
150-160°	0 lm	0.0%
160-170°	0 lm	0.0%
170-180°	0 lm	0.0%
Total	1497 lm	100.0%

Intensity peaks

Max intensity	6616 cd
Intensity, 90°	0 cd
Intensity, 0°	6616 cd

Zonal Lumen summary

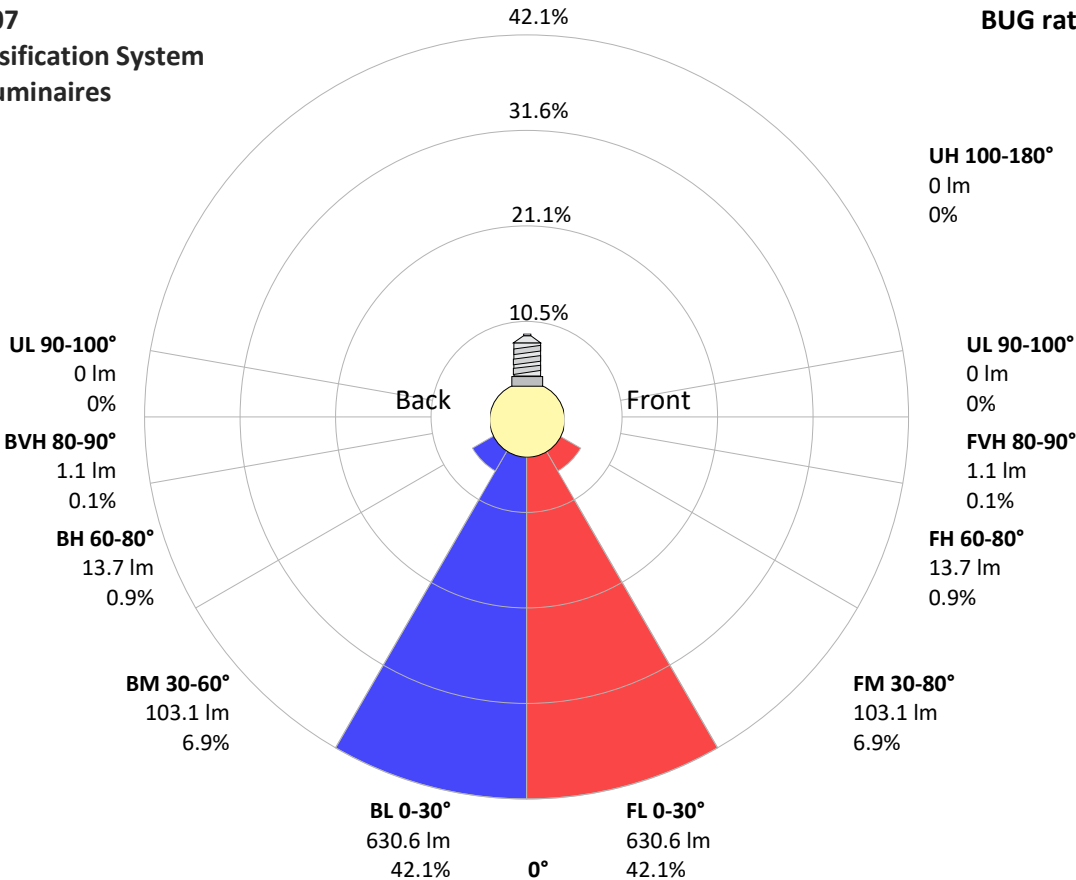
Zone (γ)	Lumen	% Total
0-30°	1261 lm	84.3%
0-40°	1375 lm	91.8%
0-60°	1467 lm	98.0%
60-90°	30 lm	2.0%
70-100°	10 lm	0.7%
90-120°	0 lm	0.0%
0-90°	1497 lm	100.0%
90-180°	0 lm	0.0%
0-180°	1497 lm	100.0%

BUG rating

	Lumen	% Total
Forward light		
Low(0-30°)	631 lm	42.1%
Medium(30-60°)	103 lm	6.9%
High(60-80°)	14 lm	0.9%
Very high(80-90°)	1 lm	0.1%
Back light		
Low(0-30°)	631 lm	42.1%
Medium(30-60°)	103 lm	6.9%
High(60-80°)	14 lm	0.9%
Very high(80-90°)	1 lm	0.1%
Uplight		
Low(90-100°)	0 lm	0.0%
High(100-180°)	0 lm	0.0%

IESNA TM-15-07 Luminaire Classification System For Outdoor Luminaires

BUG rating B2 U1 G0



Goniophotometry Report

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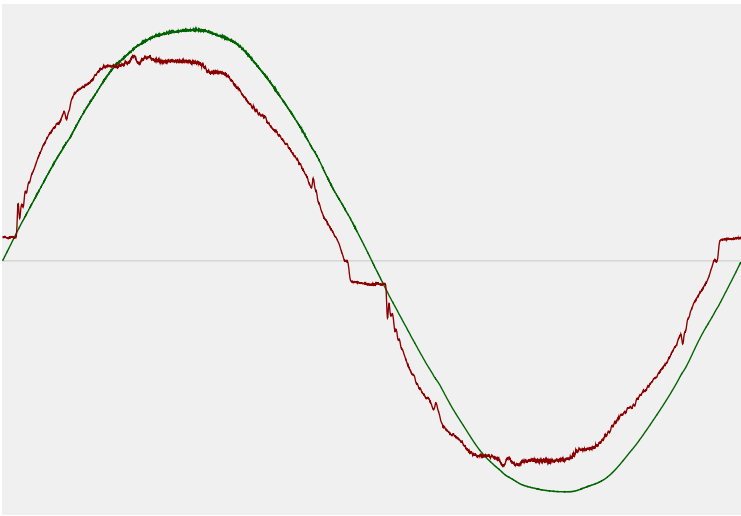


Power Details

Input Power

Power feed to light source	15.9 W
Frequency of input power	50 Hz
RMS Input voltage feed, V_{RMS}	238 V
RMS Input current feed, I_{RMS}	0.068 A
Volt-Ampere or apparent power = $V_{RMS} * I_{RMS}$	16.21 VA
Displacement factor of AC power feed	0.98
Power factor of AC current feed	0.98
Total harmonic distortion of the current	6.41%
Total harmonic distortion of the voltage	1.16%

Input Power Curve



Efficiency

Radiated power efficiency	34.5%
Lumen efficiency	94 lm/W

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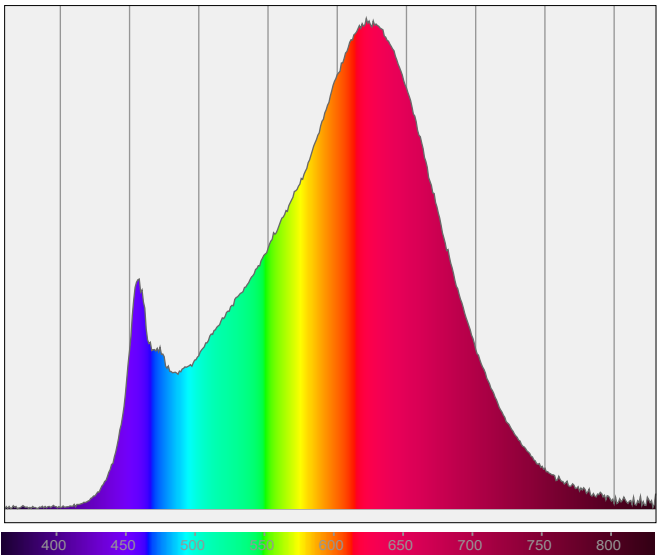
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Color Measurements

Correlated Color Temperature	CCT = 2700 K
Color Rendering TM30-18	R _f 91.4 — R _g 98.9
Color Shift, CIE duv	Duv ±0.0003

Spectral distribution



Color details

Correlated Color Temperature	CCT = 2700 K	Color coordinates CIE 1931	(x;y) = (0.460;0.411)
Color Rendering Index	CRI 92.9	Color coordinate CIEs 1960	(u;v) = (0.263;0.352)
Color Rendering Index, R9 (red component)	R9 = 67.0	Color deviation from BBL	Duv = ±0.0003
Color Rendering TM30-18	R _f 91.4 — R _g 98.9	Color coordinate CIEs 1976 (CIELUV)	(u';v') = (0.263;0.263)
Color Quality Scale	CQS = 90.7		

Goniophotometry Report

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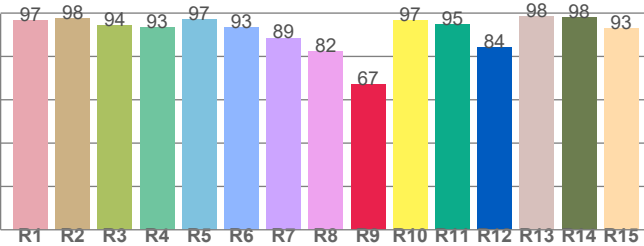
CIE 1931



CIE 1931 – zoomed on Planckian locus



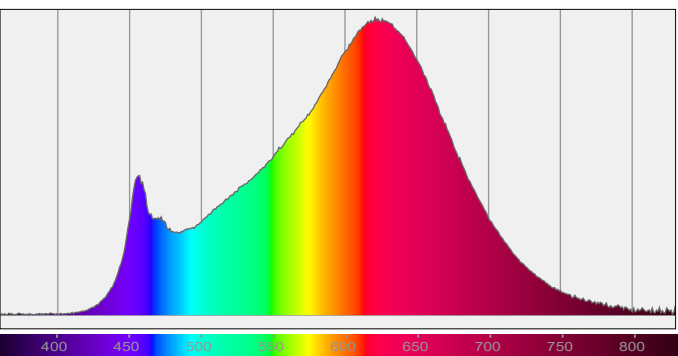
Color Rendering Index per reference color (CIE 1995)



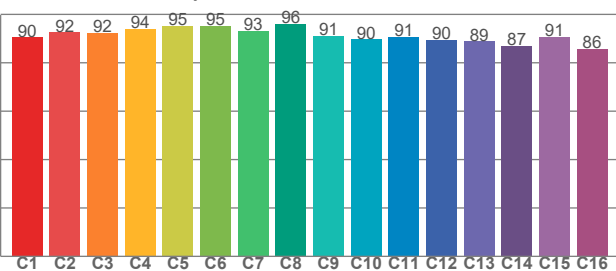
CRI R values, only R1-R8 are used to calculate final CRI value

R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
96.5	97.7	94.2	93.3	96.9	93.3	88.6	82.3	67.0	96.7	94.7	84.2	98.5	98.0	93.1

Spectral power distribution (SPD) / W/nm – 0-100%



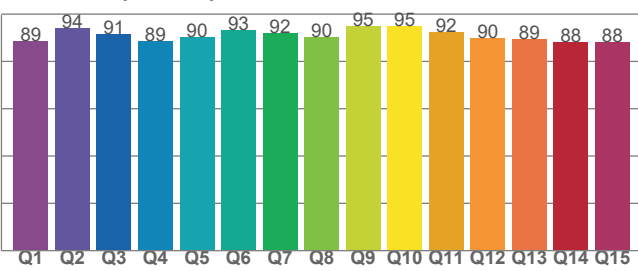
TM30-18 Rf-values per hue bin



TM30 C values, 16 binned values out of total of 99 C values

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16
90.5	92.5	92.2	93.9	95.2	95.1	93.3	95.9	91.2	89.6	90.7	89.5	88.8	87.0	90.8	85.6

Color Quality Scale by reference color



CQS Q values

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
88.6	93.9	91.5	88.7	90.2	93.1	92.0	90.2	94.8	95.1	92.2	90.0	89.3	88.2	88.3